

FCC Test Report

(PART 27)

Report No.: RFBEHG-WTW-P21050666-5

FCC ID: 2AA5WKMP8S1AA

Test Model: NAR01 (Mobile Router)

Received Date: May 24, 2021

Test Date: Jul. 15 ~ Sep. 15, 2021

Issued Date: Sep. 30, 2021

Applicant: NEC Platforms, Ltd.

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FCC Registration / 788550 / TW0003

Designation Number: 427177 / TW0011



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Release Control Record

Issue No.	Description	Date Issued
RFBEHG-WTW-P21050666-5	Original Release	Sep. 30, 2021

1 Certificate of Conformity

Product: NAR01 Mobile Router

Brand: NEC

Test Model: NAR01 (Mobile Router)

Sample Status: Engineering Sample

Applicant: NEC Platforms, Ltd.

Test Date: Jul. 15 ~ Sep. 15, 2021

Standards: FCC Part 27, Subpart C, F

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Lena Wang , Date: Sep. 30, 2021
Lena Wang / Specialist

Approved by : Dylan Chiou , Date: Sep. 30, 2021
Dylan Chiou / Senior Engineer

2 Summary of Test Results

Applied Standard: FCC Part 27 & Part 2 (LTE 17)			
FCC Clause	Test Item	Result	Remarks
2.1046 27.50(c)	Equivalent radiated power	Pass	Meet the requirement of limit.
2.1047	Modulation characteristics	Pass	Meet the requirement.
2.1055 27.54	Frequency Stability	Pass	Meet the requirement of limit.
2.1049	Emission Bandwidth	Pass	Meet the requirement of limit.
2.1051 27.53(g)	Out of Band Emission Measurements	Pass	Meet the requirement of limit.
--	Peak To Average Ratio	Pass	Meet the requirement of limit.
2.1051 27.53(g)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 27.53(g)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -46.34 dB at 1420.00 MHz.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.0400 dB
	30 MHz ~ 200 MHz	2.0153 dB
	200 MHz ~ 1000 MHz	2.0224 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	1.0121 dB
	18 GHz ~ 40 GHz	1.1508 dB

2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent Technologies	N9038A	MY52260177	Aug. 24, 2020	Aug. 23, 2021
			Sep. 01, 2021	Aug. 31, 2022
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 12, 2021	Apr. 11, 2022
HORN Antenna ETS-Lindgren	3117	00143293	Nov. 22, 2020	Nov. 21, 2021
BILOG Antenna SCHWARZBECK	VULB 9168	9168-616	Nov. 09, 2020	Nov. 08, 2021
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 13, 2021	Apr. 12, 2022
Preamplifier Agilent	310N	187226	Jun. 17, 2021	Jun. 16, 2022
Preamplifier Agilent	83017A	MY39501357	Jun. 17, 2021	Jun. 16, 2022
Preamplifier EMCI	EMC 184045	980116	Oct. 07, 2020	Oct. 06, 2021
Power Meter Anritsu	ML2495A	1012010	Sep. 01, 2020	Aug. 31, 2021
			Sep. 09, 2021	Sep. 08, 2022
Power Sensor Anritsu	MA2411B	1315050	Sep. 01, 2020	Aug. 31, 2021
			Sep. 09, 2021	Sep. 08, 2022
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(RFC-SMS-100-SMS-120+RFC-SMS-100-SMS-400)	Jun. 17, 2021	Jun. 16, 2022
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(RFC-SMS-100-SMS-24)	Jun. 17, 2021	Jun. 16, 2022
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 8.130425b	NA	NA	NA
Antenna Tower MF	NA	NA	NA	NA
Turn Table MF	NA	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA
MXG Vector signal generator Agilent	N5182B	MY53050430	Nov. 25, 2020	Nov. 24, 2021

Radio Communication Analyzer Anritsu	MT8820C	6201300640	Aug. 19, 2019	Aug. 18, 2021
			Aug. 26, 2021	Aug. 25, 2022

Note: 1. The calibration interval of the above test instruments is 12 / 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HsinTien Chamber 1.

3 General Information

3.1 General Description of EUT

Product	NAR01 Mobile Router	
Brand	NEC	
Test Model	NAR01 (Mobile Router)	
Status of EUT	Engineering Sample	
Power Supply Rating	5.0 Vdc (adapter) 3.8 Vdc (Battery)	
Modulation Type	LTE	QPSK, 16QAM, 64QAM
Frequency Range	LTE Band 17 (Channel Bandwidth: 5 MHz)	706.5 ~ 713.5 MHz
	LTE Band 17 (Channel Bandwidth: 10 MHz)	709.0 ~ 711.0 MHz
Emission Designator	LTE Band 17 (Channel Bandwidth: 5 MHz)	4M50D7W
	LTE Band 17 (Channel Bandwidth: 10 MHz)	8M97D7W
Max. ERP Power	LTE Band 17 (Channel Bandwidth: 5 MHz)	61.96 mW
	LTE Band 17 (Channel Bandwidth: 10 MHz)	64.54 mW
Antenna Type	Refer to Note as below	
Antenna Gain	Refer to Note as below	
Accessory Device	N/A	
Data Cable Supplied	N/A	

Note:

- The EUT contains following accessory devices.

Product	Brand	Model	Description
Battery	NEC	GXE-005945	3.8 Vdc, Rated 4000mAh, 16Wh

- The EUT uses following antennas.

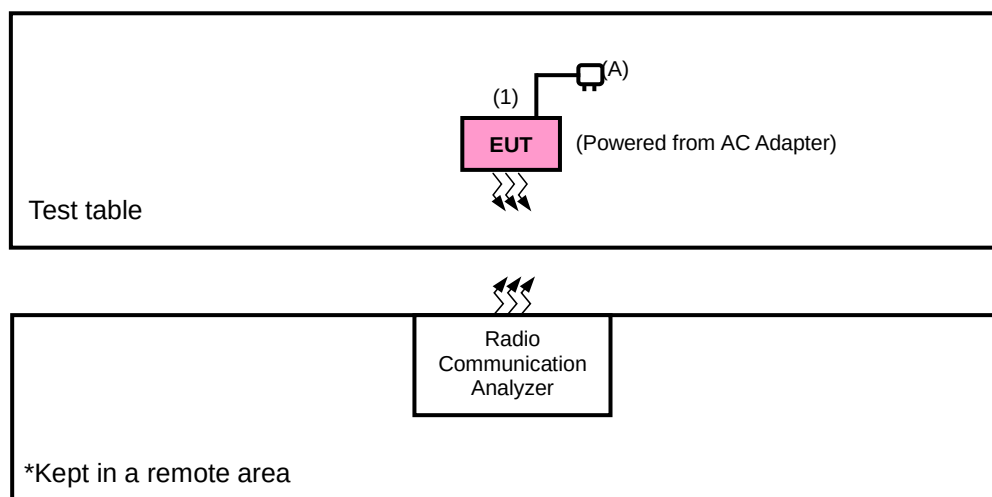
Antenna Type		Inverted L (Omni-directional)			
Band		WCDMA		LTE	
		II	V	5	17
Gain	Ant. 1 (TX/RX)	1.7	-	-	-
	Ant. 2 (TX/RX)	-	-0.8	-0.8	-4.8

*Ant. 1 & Ant. 2 is diversity.

- The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.
- The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.
- WLAN 2.4G & WWAN technology can transmit at same time.
- Spurious emission of the simultaneous operation (WLAN2.4G & WWAN) has been evaluated and no non-compliance was found.

3.2 Configuration of System under Test

<Radiated Emission Test> & <E.R.P. Test>



3.2.1 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID
A	Adapter	N/A	TC U250	N/A	N/A
B	Radio Communication Analyzer	Anritsu	MT8820C	6201300640	N/A

No.	Signal Cable Description Of The Above Support Units
1.	Type C Cable: 1M, Provided by client

Note:

1. All power cords of the above support units are non-shielded (1.8m).

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis, and antenna ports

The worst case was found when positioned as the table below. Following channel(s) was (were) selected for the final test as listed below:

Band	ERP	Radiated Emission
LTE Band 17	X-plane	X-plane

LTE Band 17

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	ERP	23755 to 23825	23755, 23790, 23825	5 MHz	QPSK, 16QAM, 64QAM	1 RB / 0 RB Offset
		23780 to 23800	23780, 23790, 23800	10 MHz	QPSK, 16QAM, 64QAM	1 RB / 0 RB Offset
-	Modulation Characteristics	23780 to 23800	23790	5 MHz	QPSK, 16QAM, 64QAM	1 RB / 0 RB Offset
-	Frequency Stability	23755 to 23825	23755, 23825	5 MHz	QPSK	1 RB / 0 RB Offset
		23780 to 23800	23780, 23800	10 MHz	QPSK	1 RB / 0 RB Offset
-	Occupied Bandwidth	23755 to 23825	23755, 23790, 23825	5 MHz	QPSK, 16QAM, 64QAM	25 RB / 0 RB Offset
		23780 to 23800	23780, 23790, 23800	10 MHz	QPSK, 16QAM, 64QAM	50 RB / 0 RB Offset
-	Peak to Average Ratio	23755 to 23825	23755, 23790, 23825	5 MHz	QPSK, 16QAM, 64QAM	1 RB / 12 RB Offset
		23780 to 23800	23780, 23790, 23800	10 MHz	QPSK, 16QAM, 64QAM	1 RB / 24 RB Offset
-	Band Edge	23755 to 23825	23755	5 MHz	QPSK	1 RB / 0 RB Offset
						25 RB / 0 RB Offset
			23825	5 MHz	QPSK	1 RB / 24 RB Offset
						25 RB / 0 RB Offset
		23780 to 23800	23780	10 MHz	QPSK	1 RB / 0 RB Offset
						50 RB / 0 RB Offset
-	Conducted Emission	23755 to 23825	23755, 23790, 23825	5 MHz	QPSK	1 RB / 49 RB Offset
		23780 to 23800	23780, 23790, 23800	10 MHz	QPSK	50 RB / 0 RB Offset
-	Radiated Emission	23755 to 23825	23755, 23790, 23825	5 MHz	QPSK	1 RB / 0 RB Offset
		23780 to 23800	23780, 23790, 23800	10 MHz	QPSK	1 RB / 0 RB Offset

Note:

1. This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation. Therefore, only ERP, modulation characteristics, occupied bandwidth and peak to average ratio items had been tested under QPSK, 16QAM, 64QAM mode, the other items were performed under QPSK mode only.
2. For radiated emission above 1 GHz, according to 3GPP 36.521 Section 6.6.3.1.4, choose the lowest, 5 MHz & highest channel bandwidth for final test.
3. For radiated emissions below 1 GHz, select the worst radiated emission channel for final testing.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
ERP / EIRP	25 deg. C, 65 % RH	120 Vac, 60 Hz	Wayne Lin
Modulation Characteristics	25 deg. C, 65 % RH	120 Vac, 60 Hz	Wayne Lin
Frequency Stability	25 deg. C, 65 % RH	3.8 Vdc	Wayne Lin
Occupied Bandwidth	25 deg. C, 65 % RH	120 Vac, 60 Hz	Wayne Lin
Band Edge	25 deg. C, 65 % RH	120 Vac, 60 Hz	Wayne Lin
Peak to Average Ratio	25 deg. C, 65 % RH	120 Vac, 60 Hz	Wayne Lin
Conducted Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Wayne Lin
Radiated Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Karl Lee

3.4 EUT Operating Conditions

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency

3.5 General Description of Applied Standards and references

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test Standard:

FCC 47 CFR Part 2

FCC 47 CFR Part 27

ANSI 63.26-2015

Note: All test items have been performed and recorded as per the above standards.

References Test Guidance:

KDB 971168 D01 Power Meas License Digital Systems v03r01

ANSI/TIA/EIA-603-E 2016

Note: All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Output Power Measurement

4.1.1 Limits of Output Power Measurement

Control and mobile stations in the 698-746 MHz band are limited to 30 watts ERP.

Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

4.1.2 Test Procedures

EIRP / ERP Measurement:

- a. All measurements were done at low, middle and high operational frequency range. RBW is 5 MHz ∙ 10 MHz ∙ 15 MHz for LTE mode, and VBW $\geq 3 \times$ RBW.
- b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) and/or 1.5 m (above 1 GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- c. $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}$. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, $E.R.P \text{ power} = E.I.R.P \text{ power} - 2.15 \text{ dB}$.

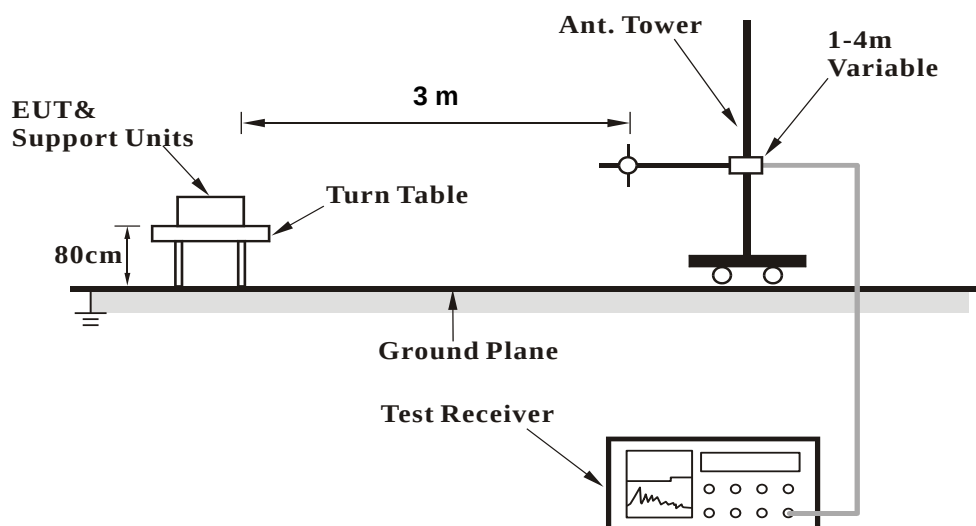
Conducted Power Measurement:

- a. The EUT was set up for the maximum power with LTE link data modulation and link up with simulator.
- b. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

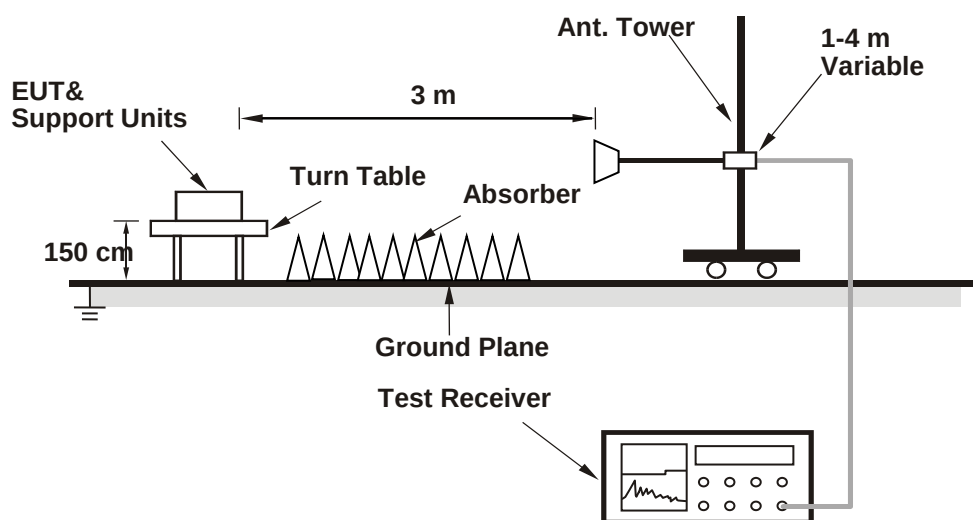
4.1.3 Test Setup

EIRP / ERP Measurement:

<Radiated Emission below or equal 1 GHz>

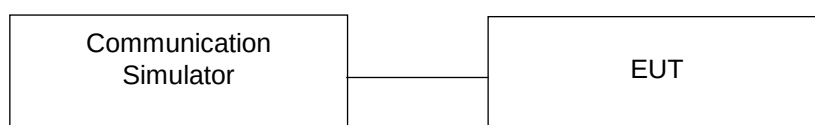


<Radiated Emission above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

Conducted Power Measurement:



4.1.4 Test Results

Conducted Output Power (dBm)

LTE Band 17															
BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		23780	23790	23800				Channel		23755	23790	23825	
		Frequency (MHz)		709.0	710.0	711.0				Frequency (MHz)		706.5	710.0	713.5	
10M	QPSK	1	0	23.13	23.34	23.22	0	5M	QPSK	1	0	23.05	23.24	23.13	0
		1	24	22.89	23.1	22.98	0			1	12	22.86	23.04	22.9	0
		1	49	22.75	22.96	22.84	0			1	24	22.72	22.96	22.81	0
		25	0	21.82	22.13	21.91	1			12	0	21.64	21.83	21.68	1
		25	12	21.66	21.87	21.75	1			12	6	21.78	21.98	21.82	1
		25	25	21.75	21.96	21.84	1			12	13	21.73	21.88	21.76	1
		50	0	21.87	22.08	21.96	1			25	0	21.78	22.05	21.94	1
		1	0	22.14	22.35	22.23	1		16QAM	1	0	22.05	22.28	22.18	1
	16QAM	1	24	22.16	22.37	22.25	1			1	12	22.14	22.3	22.19	1
		1	49	22	22.21	22.09	1			1	24	21.91	22.21	22.02	1
		25	0	20.76	20.97	20.85	2			12	0	20.71	20.95	20.85	2
		25	12	20.86	21.07	20.95	2			12	6	20.78	21.04	20.93	2
		25	25	20.82	21.03	20.91	2			12	13	20.8	21.01	20.85	2
		50	0	20.77	20.98	20.86	2			25	0	20.72	20.89	20.85	2
	64QAM	1	0	21.01	21.22	21.1	2		64QAM	1	0	21.01	21.21	21.04	2
		1	24	20.97	21.18	21.06	2			1	12	20.88	21.17	21.03	2
		1	49	20.84	21.05	20.93	2			1	24	20.82	21.01	20.84	2
		25	0	19.65	19.86	19.74	3			12	0	19.61	19.83	19.7	3
		25	12	19.8	20.01	19.89	3			12	6	19.8	19.91	19.84	3
		25	25	19.75	19.96	19.84	3			12	13	19.68	19.86	19.81	3
		50	0	19.73	19.94	19.82	3			25	0	19.64	19.84	19.77	3

ERP Power (dBm)

LTE Band 17							
Channel Bandwidth: 5 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
X	23755	706.5	-15.02	32.72	17.70	58.87	H
	23790	710.0	-14.93	32.74	17.81	60.34	
	23825	713.5	-14.67	32.59	17.92	61.96	
	23755	706.5	-19.78	32.69	12.91	19.54	V
	23790	710.0	-19.75	32.81	13.06	20.23	
	23825	713.5	-19.67	32.74	13.07	20.28	
Channel Bandwidth: 5 MHz / 16QAM							
X	23755	706.5	-16.02	32.72	16.70	46.76	H
	23790	710.0	-15.94	32.74	16.80	47.82	
	23825	713.5	-15.67	32.59	16.92	49.22	
	23755	706.5	-20.78	32.69	11.91	15.52	V
	23790	710.0	-20.76	32.81	12.05	16.03	
	23825	713.5	-20.66	32.74	12.08	16.14	
Channel Bandwidth: 5 MHz / 64QAM							
X	23755	706.5	-17.13	32.72	15.59	36.22	H
	23790	710.0	-17.00	32.74	15.74	37.46	
	23825	713.5	-17.10	32.59	15.49	35.41	
	23755	706.5	-21.27	32.69	11.42	13.87	V
	23790	710.0	-21.47	32.81	11.34	13.61	
	23825	713.5	-21.69	32.74	11.05	12.73	

Note: ERP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 17							
Channel Bandwidth: 10 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (mW)	Polarization (H/V)
X	23780	709.0	-14.99	32.73	17.74	59.39	H
	23790	710.0	-14.89	32.74	17.85	60.94	
	23800	711.0	-14.63	32.73	18.10	64.54	
	23780	709.0	-19.74	32.75	13.01	20.00	V
	23790	710.0	-19.71	32.81	13.10	20.42	
	23800	711.0	-19.63	32.84	13.21	20.94	
Channel Bandwidth: 10 MHz / 16QAM							
X	23780	709.0	-15.99	32.73	16.74	47.17	H
	23790	710.0	-15.88	32.74	16.86	48.52	
	23800	711.0	-15.64	32.73	17.09	51.14	
	23780	709.0	-20.74	32.75	12.01	15.89	V
	23790	710.0	-20.71	32.81	12.10	16.22	
	23800	711.0	-20.64	32.84	12.20	16.60	
Channel Bandwidth: 10 MHz / 64QAM							
X	23780	709.0	-17.10	32.73	15.63	36.53	H
	23790	710.0	-16.92	32.74	15.82	38.19	
	23800	711.0	-17.00	32.73	15.73	37.39	
	23780	709.0	-21.69	32.75	11.06	12.76	V
	23790	710.0	-21.60	32.81	11.21	13.21	
	23800	711.0	-21.56	32.84	11.28	13.43	

Note: ERP (dBm) = Reading (dBm) + Correction Factor (dB)

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

N/A

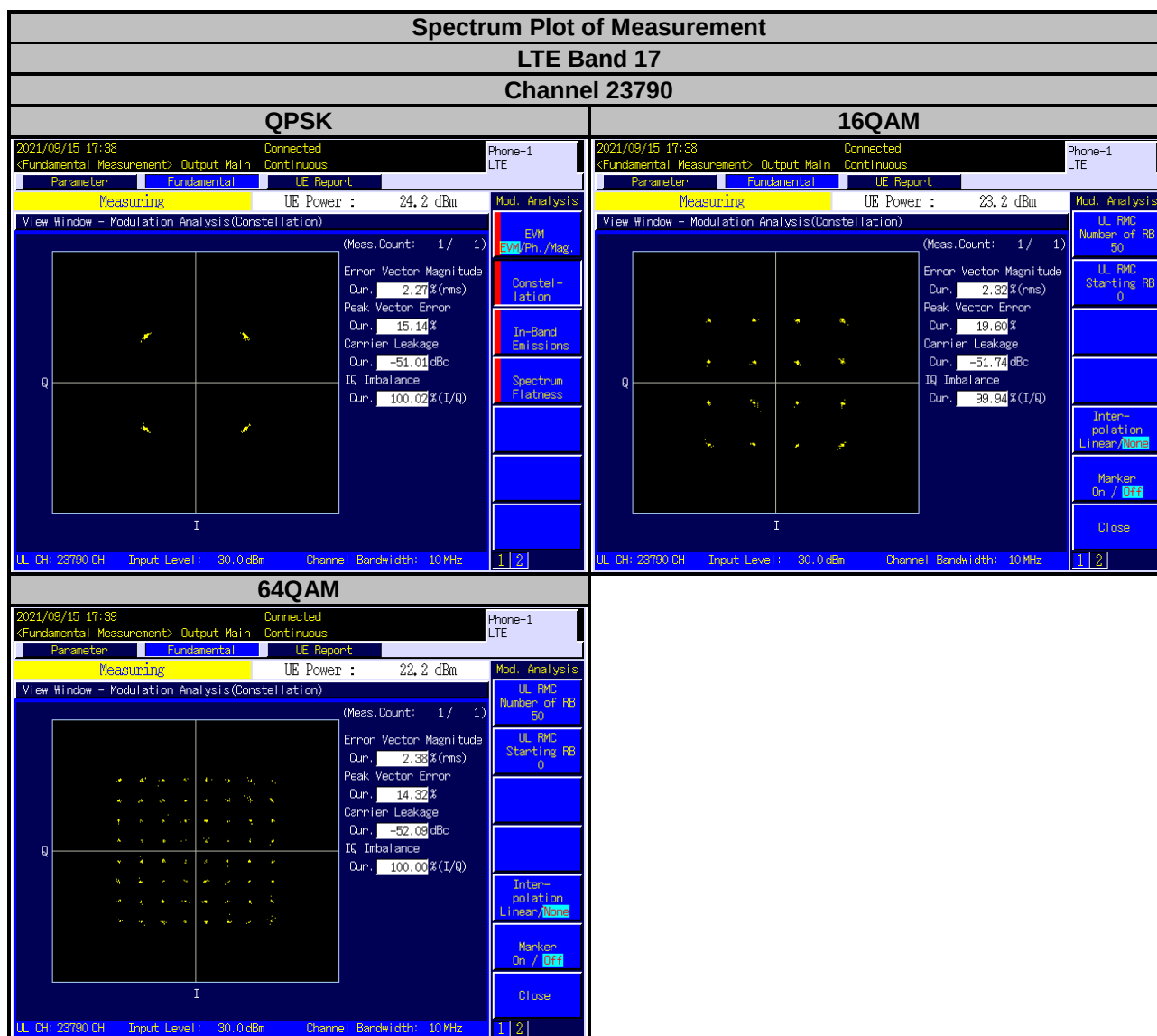
4.2.2 Test Setup



4.2.3 Test Procedure

Connect the EUT to Communication Simulator via the antenna connector. The frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

4.2.4 Test Results



4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

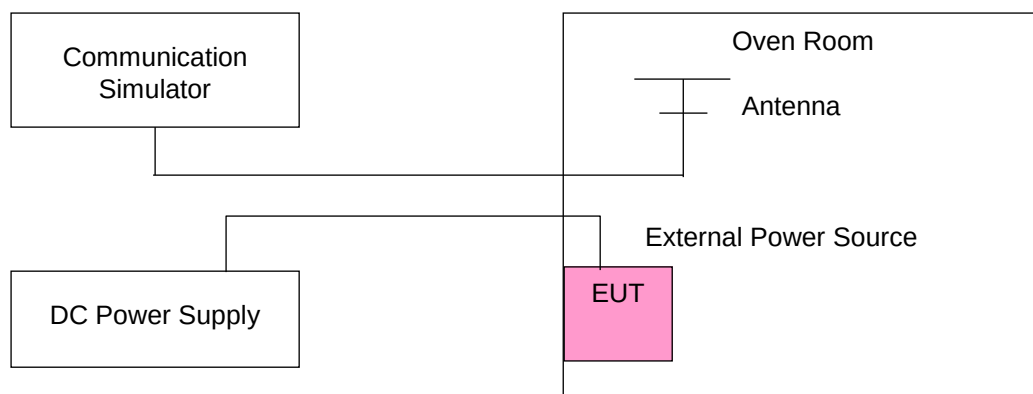
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

4.3.2 Test Procedure

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

Note: The frequency error was recorded frequency error from the communication simulator.

4.3.3 Test Setup



4.3.4 Test Results

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 17			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.8	706.499996	-0.005662	713.499999	-0.001402
3.4	706.500010	0.014154	713.499992	-0.011212
4.37	706.500003	0.004246	713.499996	-0.005606

Note: The applicant defined the normal working voltage of the battery is from 3.4 Vdc to 4.37 Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 17			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	706.500004	0.005662	713.499997	-0.004205
-20	706.499991	-0.012739	713.500002	0.002803
-10	706.499995	-0.007077	713.500008	0.011212
0	706.500006	0.008493	713.499995	-0.007008
10	706.499990	-0.014154	713.499997	-0.004205
20	706.499990	-0.014154	713.499994	-0.008409
30	706.500010	0.014154	713.500004	0.005606
40	706.500002	0.002831	713.499993	-0.009811
50	706.500004	0.005662	713.499991	-0.012614
55	706.500005	0.007077	713.500010	0.014015

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 17			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.8	709.000004	0.005642	711.000009	0.012658
3.4	709.000010	0.014104	710.999992	-0.011252
4.37	708.999991	-0.012694	711.000005	0.007032

Note: The applicant defined the normal working voltage of the battery is from 3.4 Vdc to 4.37 Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 17			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	709.000006	0.008463	711.000009	0.012658
-20	708.999990	-0.014104	710.999991	-0.012658
-10	708.999990	-0.014104	711.000008	0.011252
0	708.999999	-0.001410	711.000003	0.004219
10	709.000001	0.001410	710.999992	-0.011252
20	709.000003	0.004231	711.000006	0.008439
30	709.000007	0.009873	711.000009	0.012658
40	709.000010	0.014104	711.000008	0.011252
50	708.999992	-0.011283	711.000010	0.014065
55	709.000004	0.005642	711.000003	0.004219

4.4 Occupied Bandwidth Measurement

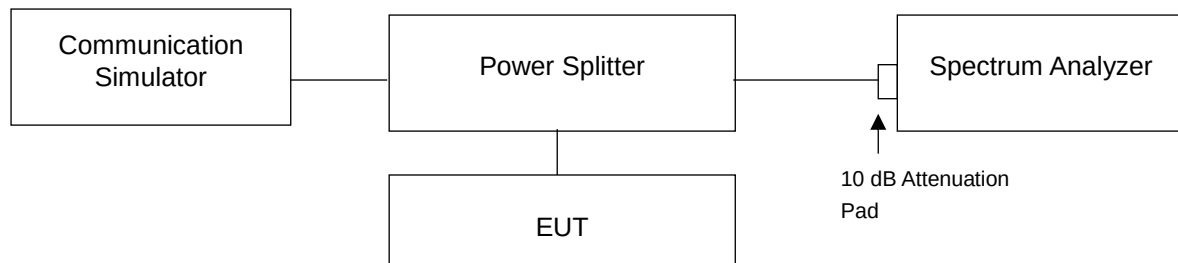
4.4.1 Limits of Occupied Bandwidth Measurement

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

4.4.2 Test Procedure

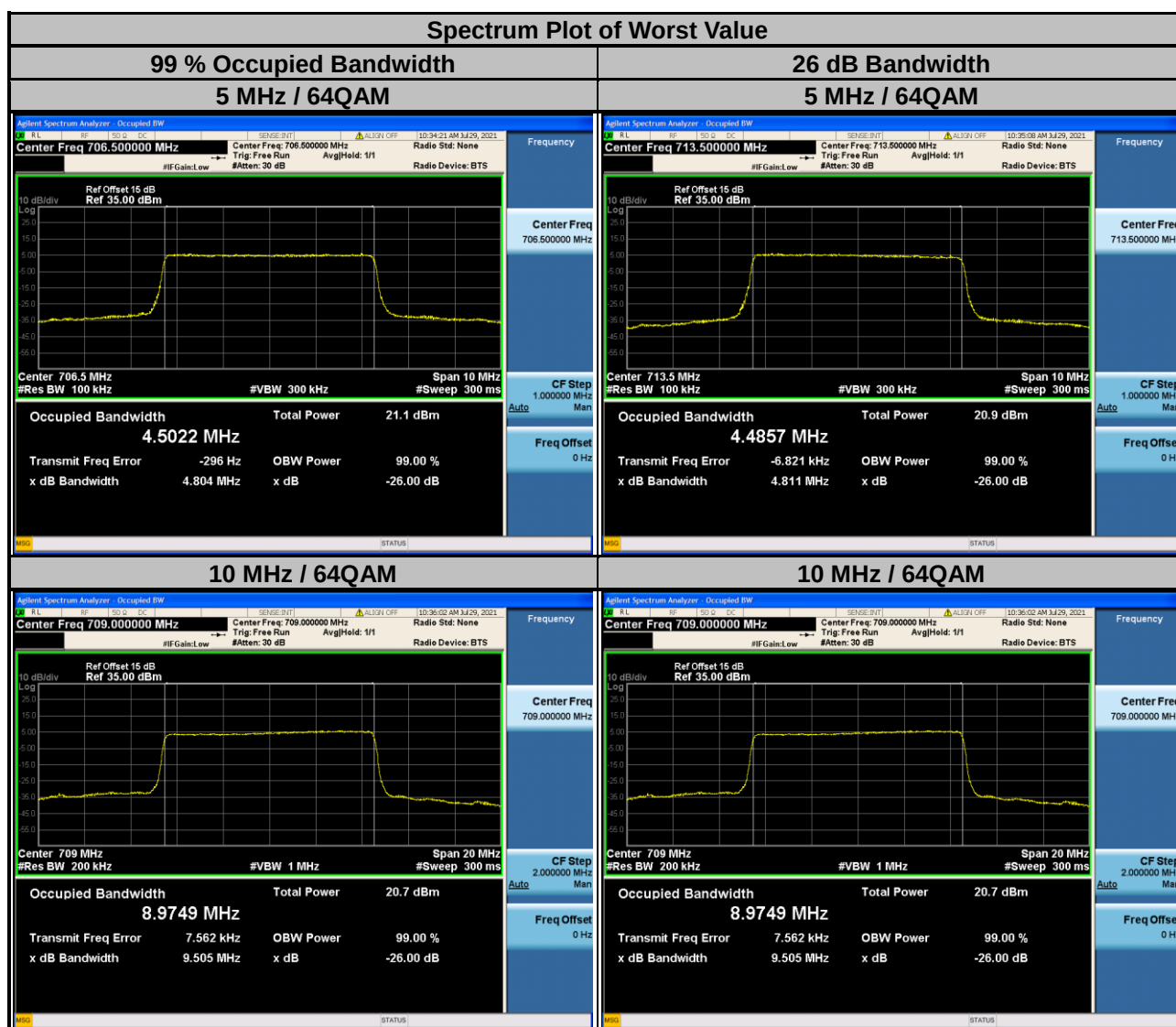
- The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
- Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

4.4.3 Test Setup



4.4.4 Test Result

LTE Band 17							
Channel Bandwidth: 5 MHz							
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)			26 dB Bandwidth (MHz)		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
23755	706.5	4.49	4.50	4.50	4.79	4.79	4.80
23790	710.0	4.49	4.49	4.49	4.77	4.77	4.80
23825	713.5	4.48	4.49	4.49	4.77	4.77	4.81
Channel Bandwidth: 10 MHz							
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)			26 dB Bandwidth (MHz)		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
23780	709.0	8.96	8.97	8.97	9.47	9.49	9.51
23790	710.0	8.95	8.95	8.95	9.47	9.48	9.48
23800	711.0	8.94	8.95	8.95	9.47	9.47	9.48

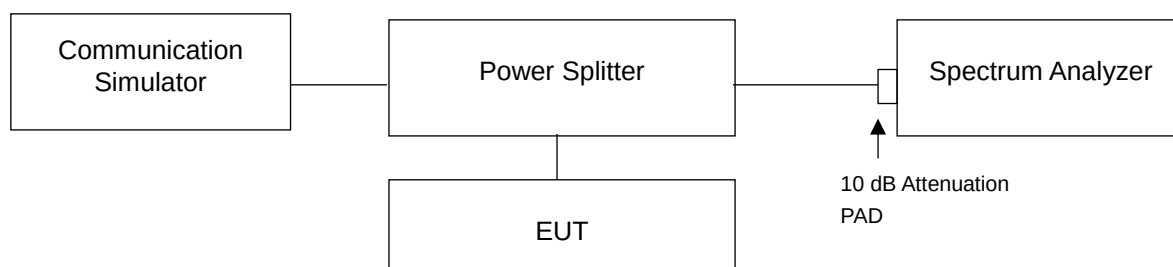


4.5 Band Edge Measurement

4.5.1 Limits of Band Edge Measurement

According to FCC 27.53(g), for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

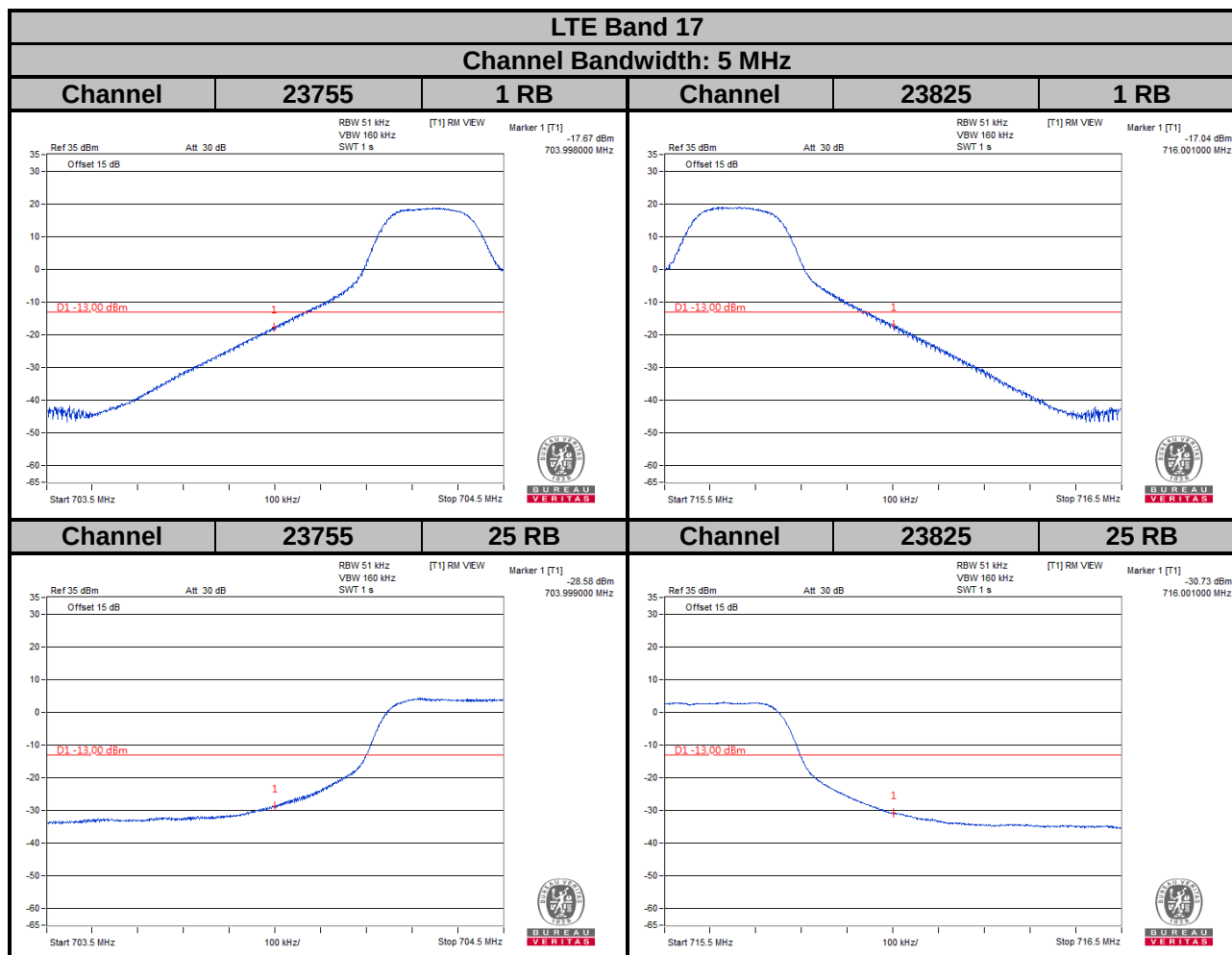
4.5.2 Test Setup

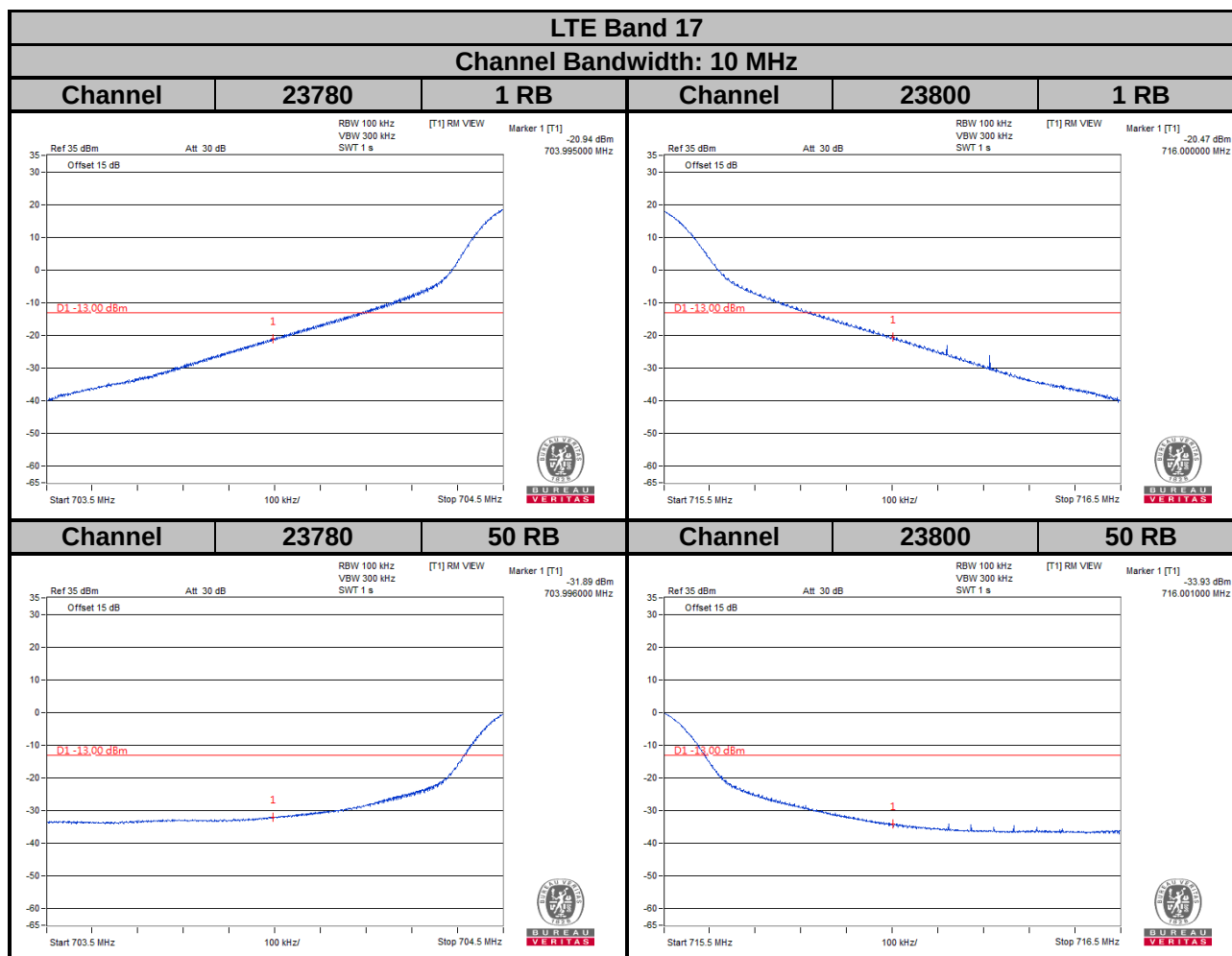


4.5.3 Test Procedures

- All measurements were done at low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 51 kHz and VB of the spectrum is 160 kHz (LTE Bandwidth 5 MHz).
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (LTE Bandwidth 10 MHz).
- Record the max. trace plot into the test report.

4.5.4 Test Results



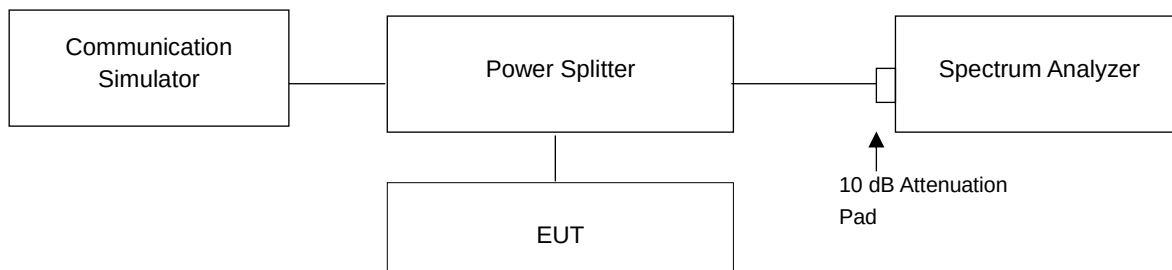


4.6 Peak to Average Ratio

4.6.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB.

4.6.2 Test Setup

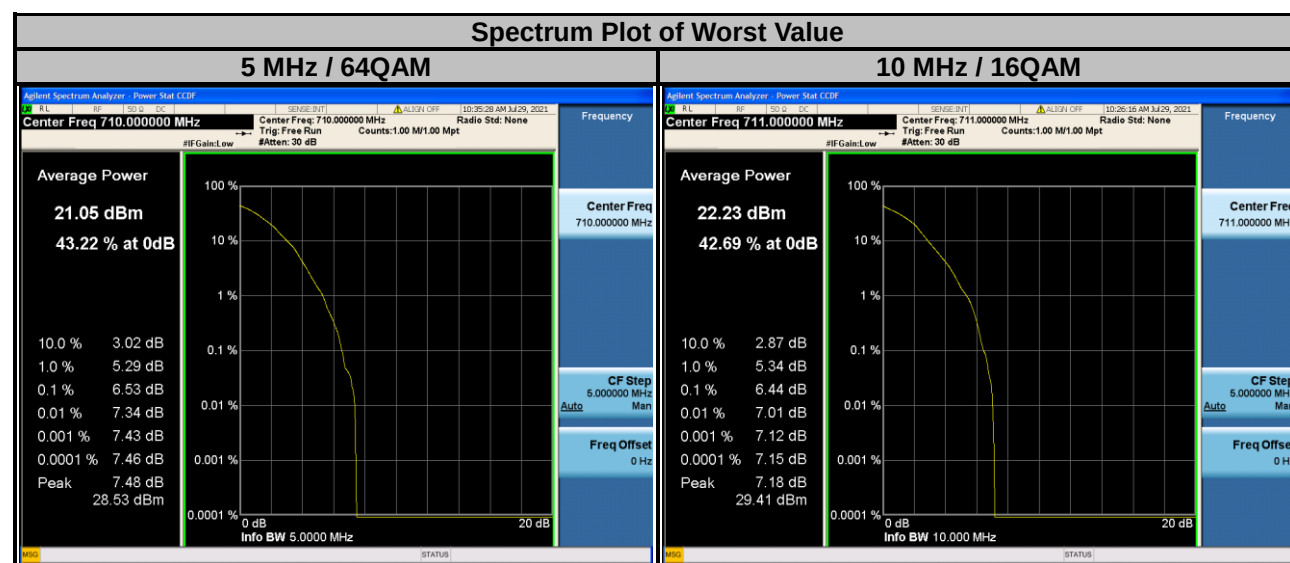


4.6.3 Test Procedures

1. Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1 %.

4.6.4 Test Results

LTE Band 17									
Channel Bandwidth: 5 MHz					Channel Bandwidth: 10 MHz				
Channel	Frequency (MHz)	Peak to Average Ratio (dB)			Channel	Frequency (MHz)	Peak to Average Ratio (dB)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
23755	706.5	5.08	6.05	6.38	23780	709.0	5.10	6.13	6.41
23790	710.0	5.38	6.47	6.53	23790	710.0	5.06	6.15	6.20
23825	713.5	4.77	5.80	6.30	23800	711.0	5.32	6.44	6.43

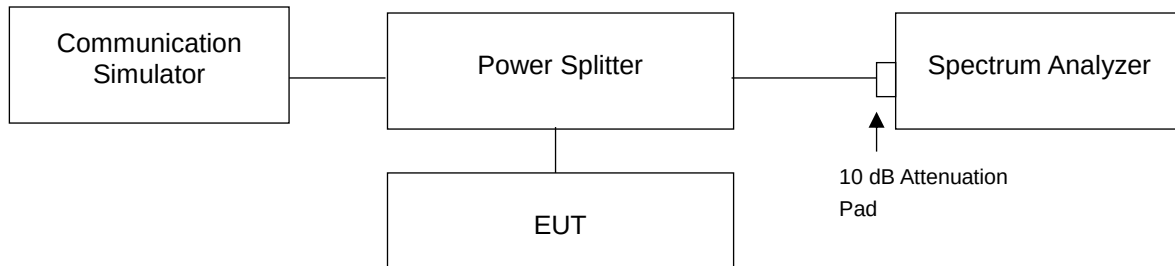


4.7 Conducted Spurious Emissions

4.7.1 Limits of Conducted Spurious Emissions Measurement

According to FCC 27.53(g), for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. The limit of emissions is equal to -13 dBm.

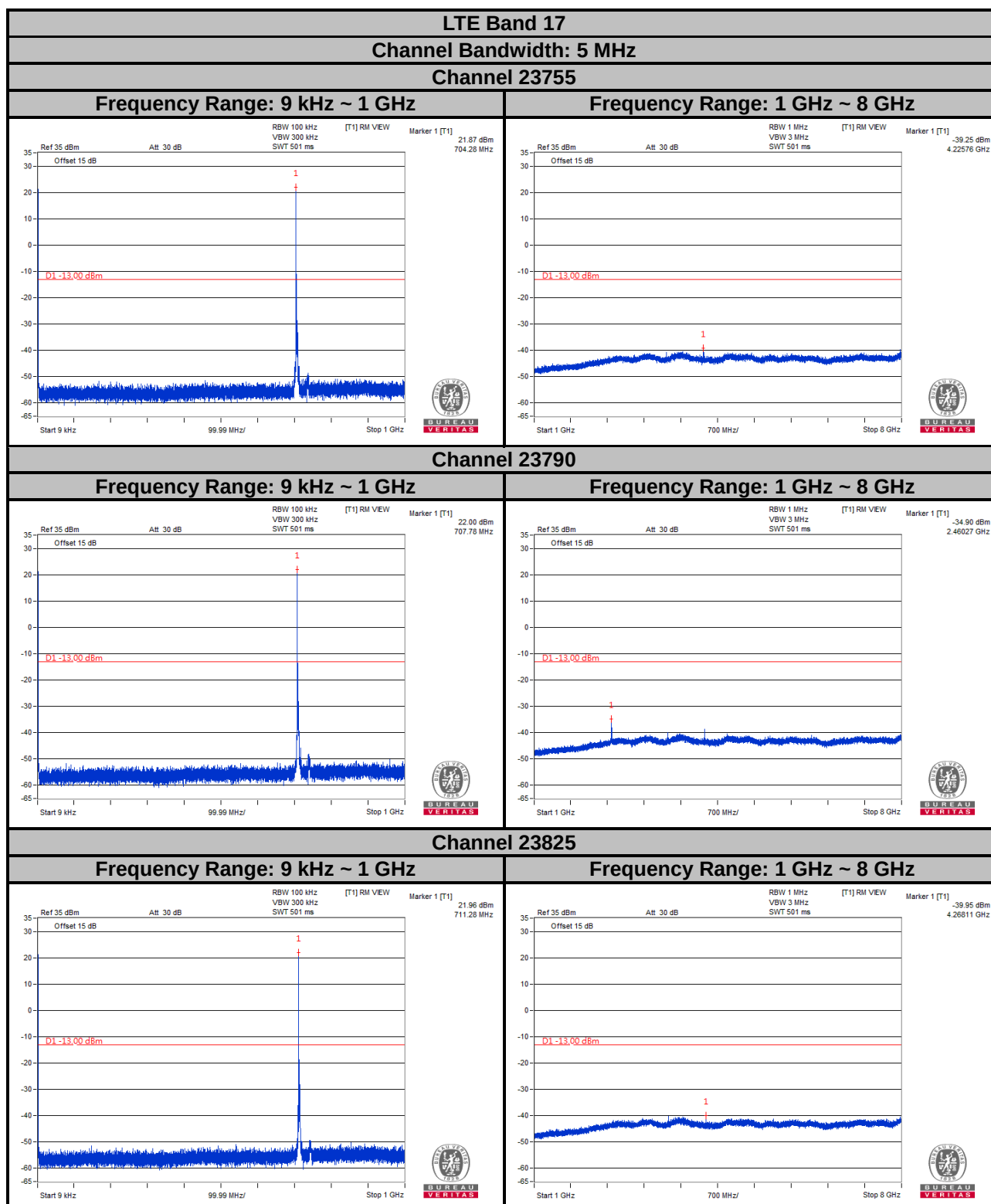
4.7.2 Test Setup



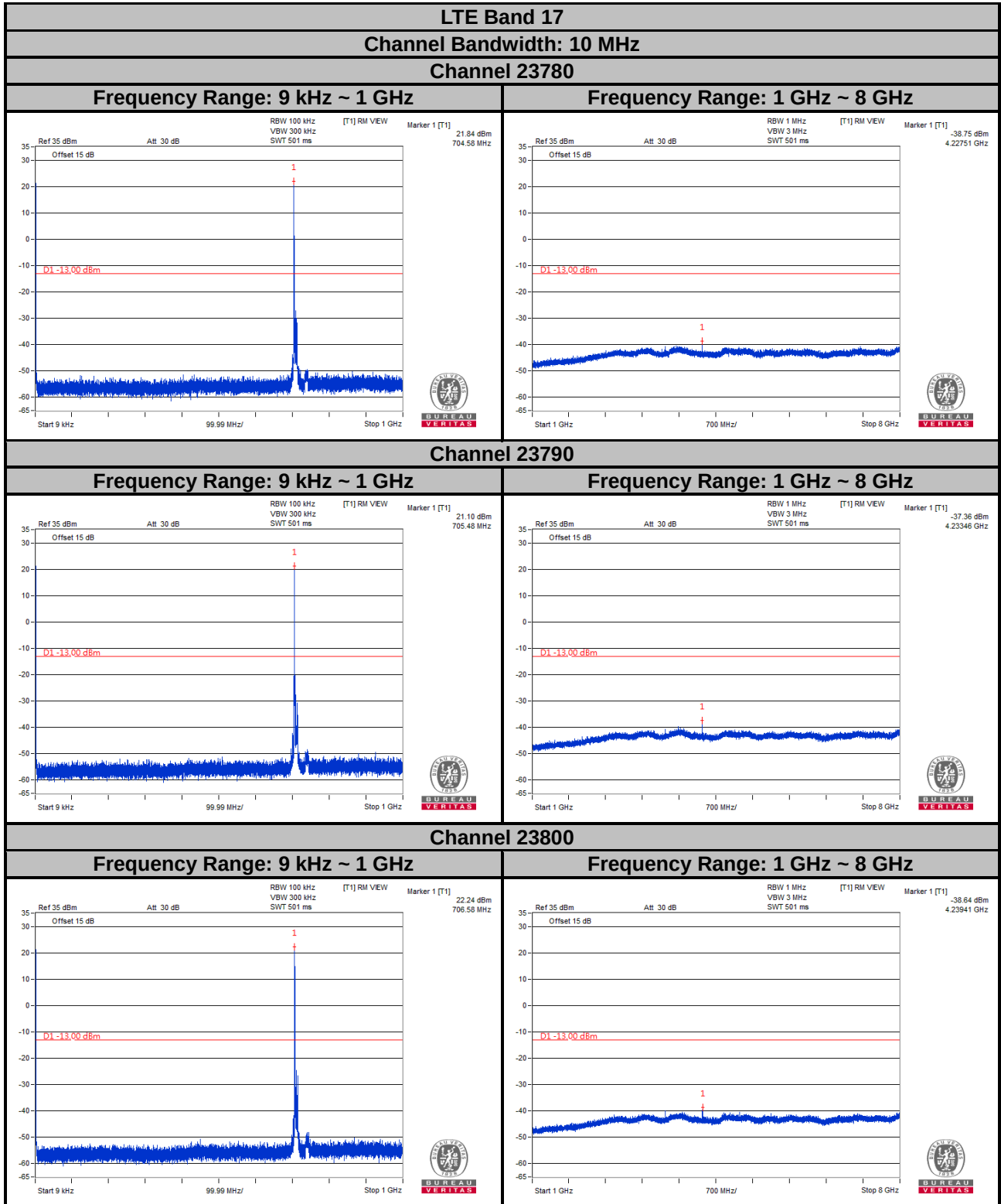
4.7.3 Test Procedure

- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range is from 9 kHz to 1 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 100 kHz and VBW = 300 kHz is used for conducted emission measurement.
- Measuring frequency range is from 1 GHz to 8 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 1 MHz and VBW = 3 MHz is used for conducted emission measurement.

4.7.4 Test Results



Note: The signal over the limit in 9 kHz is from spectrum analyzer.



Note: The signal over the limit in 9 kHz is from spectrum analyzer.

4.8 Radiated Emission Measurement

4.8.1 Limits of Radiated Emission Measurement

According to FCC 27.53(g), for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. The limit of emissions is equal to -13 dBm.

4.8.2 Test Procedure

- a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) and/or 1.5 m (above 1 GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- b. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution horn.
- c. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, E.R.P power = E.I.R.P power - 2.15 dB.

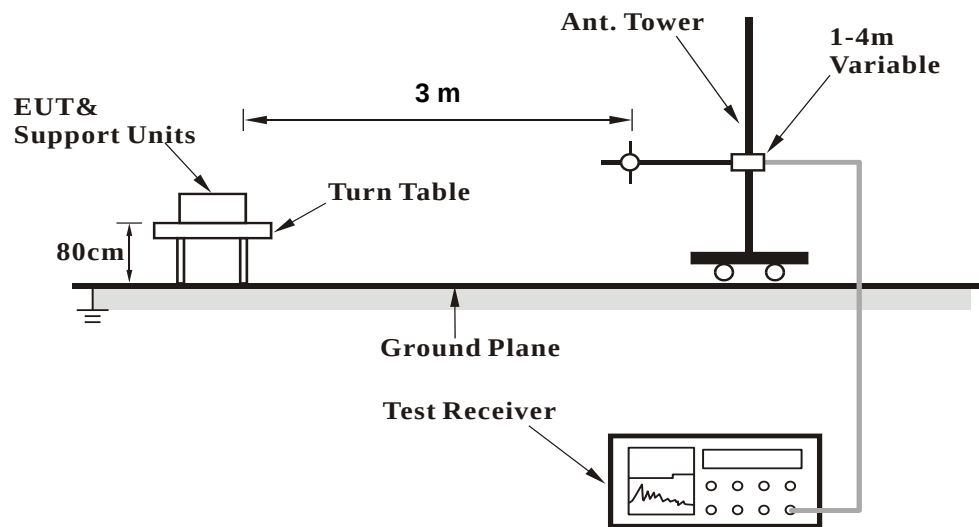
Note: The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz.

4.8.3 Deviation from Test Standard

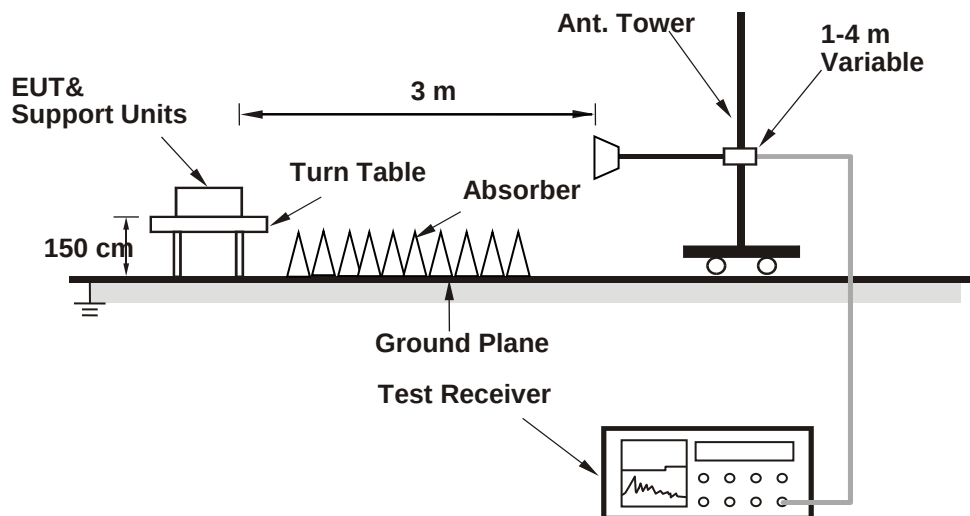
No deviation.

4.8.4 Test Setup

<Radiated Emission below or equal 1 GHz>



<Radiated Emission above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.8.5 Test Results

LTE Band 17

Channel Bandwidth: 5 MHz / QPSK

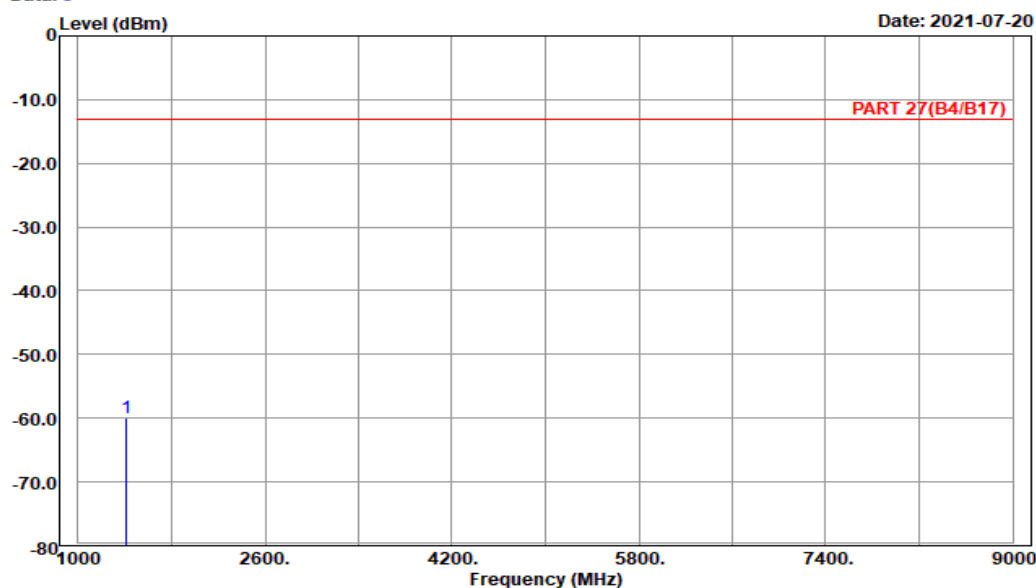
Low Channel



Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch

A D T

Data: 3



Site : 966 chamber 1
Condition: PART 27(B4/B17) Horizontal
Remark : LTE_Band 17_Link_L-Ch
Tested by: Karl Lee

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBm	dBm	dB	dBm	dB	
1 pp	1413.00	-59.86	-66.22	6.36	-13.00	-46.86	Peak

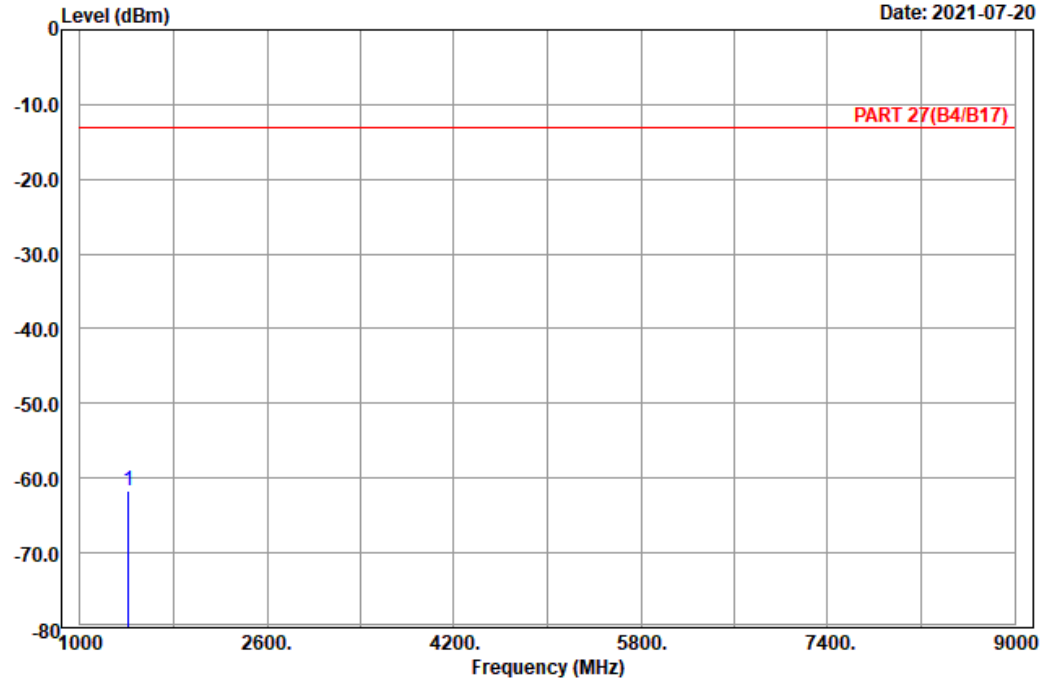


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A D T

Data: 4

Date: 2021-07-20



Site : 966 chamber 1
Condition: PART 27(B4/B17) Vertical
Remark : LTE_Band 17_Link_L-Ch
Tested by: Karl Lee

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBm	dBm	dB	dBm	dB	
1 pp	1413.00	-61.79	-68.15	6.36	-13.00	-48.79	Peak

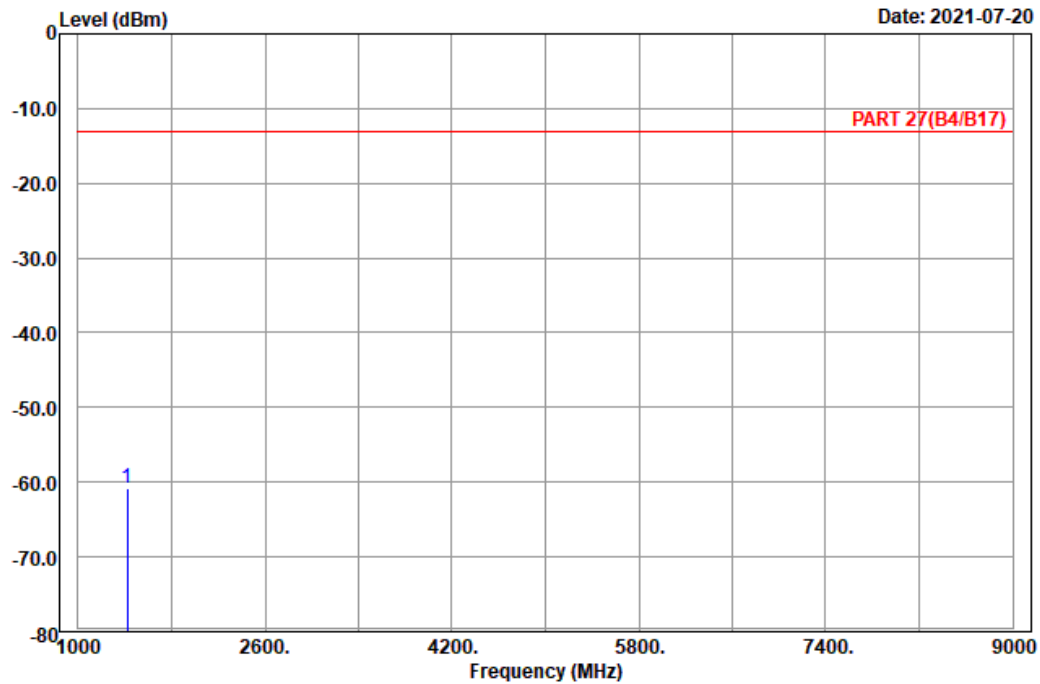
Middle Channel



Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch

A D T

Data: 3



Site : 966 chamber 1
Condition: PART 27(B4/B17) Horizontal
Remark : LTE_Band 17_Link_M-Ch
Tested by: Karl Lee

		Read	Limit	Over	
Freq	Level	Level	Factor	Line	Limit Remark
MHz	dBm	dBm	dB	dBm	dB
1 pp 1420.00	-60.90	-67.26	6.36	-13.00	-47.90 Peak

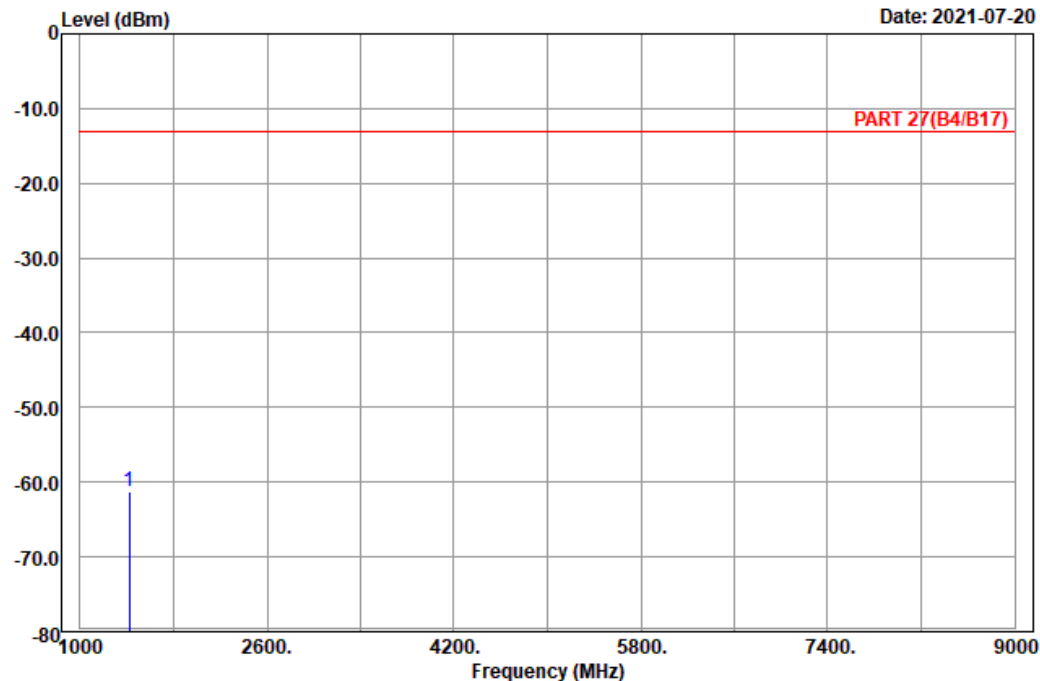


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A D T

Data: 4

Date: 2021-07-20



Site : 966 chamber 1
Condition: PART 27(B4/B17) Vertical
Remark : LTE_Band 17_Link_M-Ch
Tested by: Karl Lee

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBm	dBm	dB	dBm	dB	
1 pp	1420.00	-61.26	-67.62	6.36	-13.00	-48.26	Peak

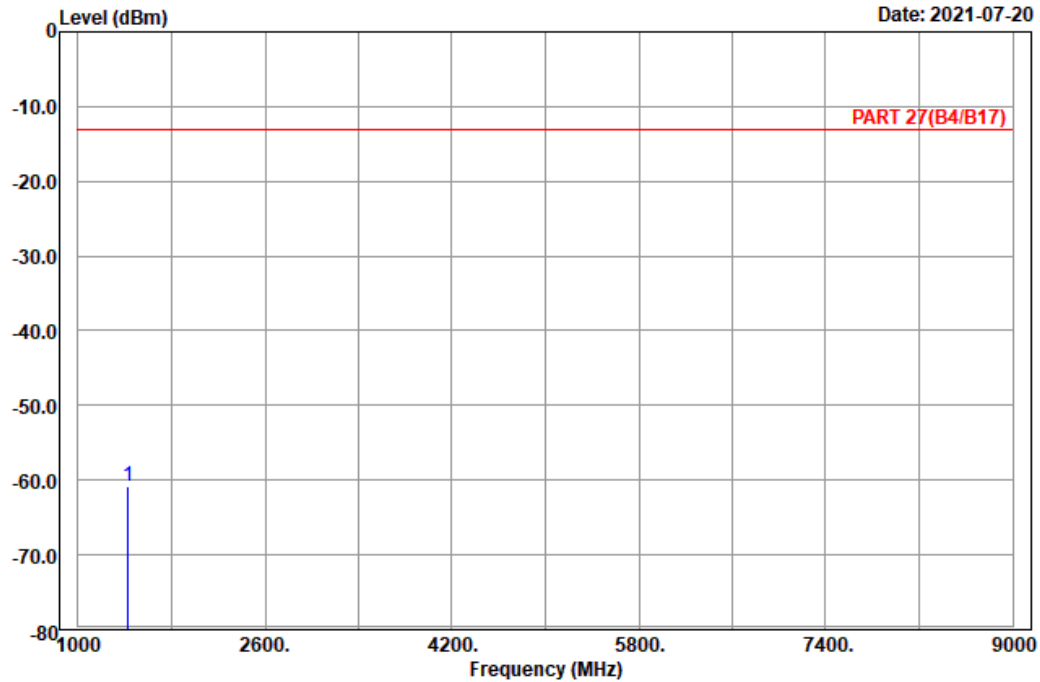
High Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 3



Site : 966 chamber 1
 Condition: PART 27(B4/B17) Horizontal
 Remark : LTE_Band 17_Link_H-Ch
 Tested by: Karl Lee

		Read	Limit	Over	
Freq	Level	Level	Factor	Line	Limit Remark
MHz	dBm	dBm	dB	dBm	dB
1 pp 1427.00	-60.74	-66.98	6.24	-13.00	-47.74 Peak

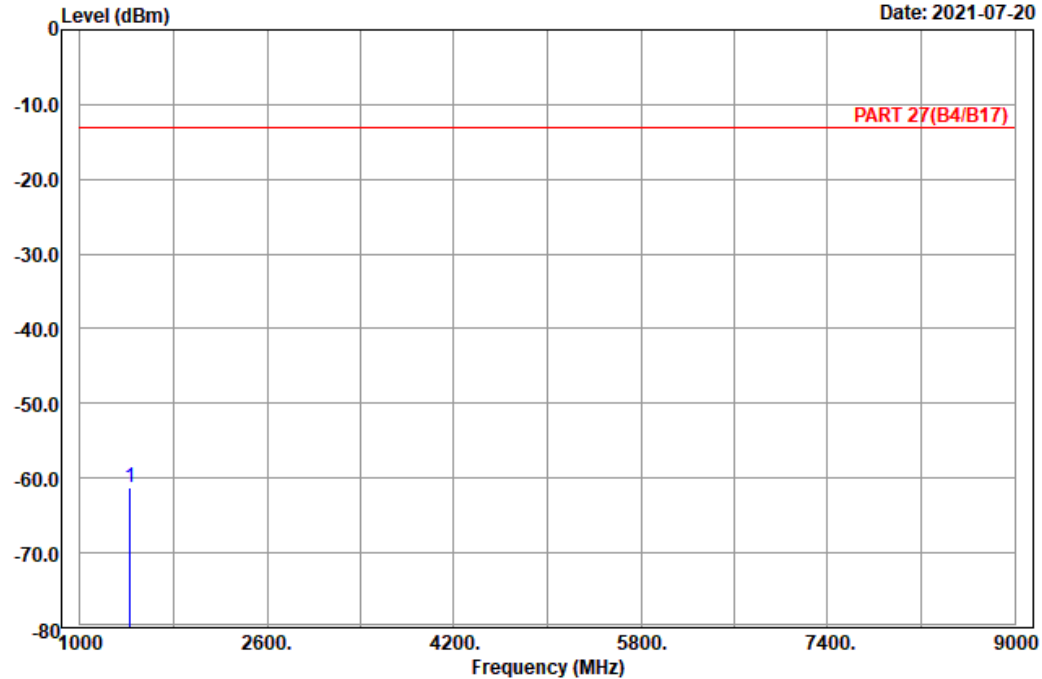


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 4

Date: 2021-07-20



Site : 966 chamber 1
Condition: PART 27(B4/B17) Vertical
Remark : LTE_Band 17_Link_H-Ch
Tested by: Karl Lee

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBm	dBm	dB	dBm	dB	
1 pp	1427.00	-61.16	-67.40	6.24	-13.00	-48.16	Peak

Channel Bandwidth: 10 MHz / QPSK
Low Channel

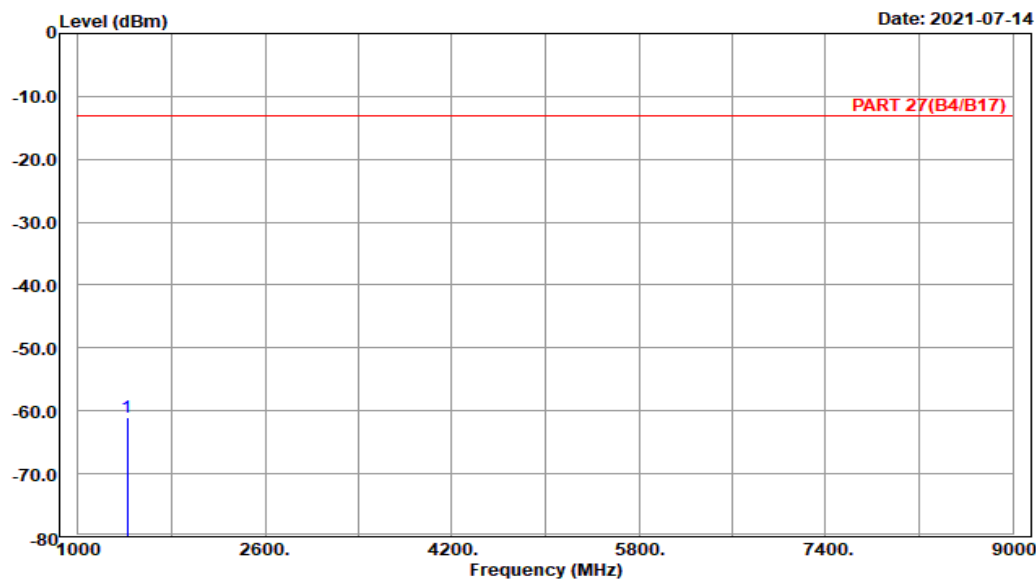


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A D T

Data: 5

Date: 2021-07-14



Site : 966 chamber 1
Condition: PART 27(B4/B17) Horizontal
Remark : LTE_Band 17_Link_L-Ch
Tested by: Karl Lee

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBm	dBm	dB	dBm	dB	
1 pp	1418.00	-61.12	-67.48	6.36	-13.00	-48.12	Peak

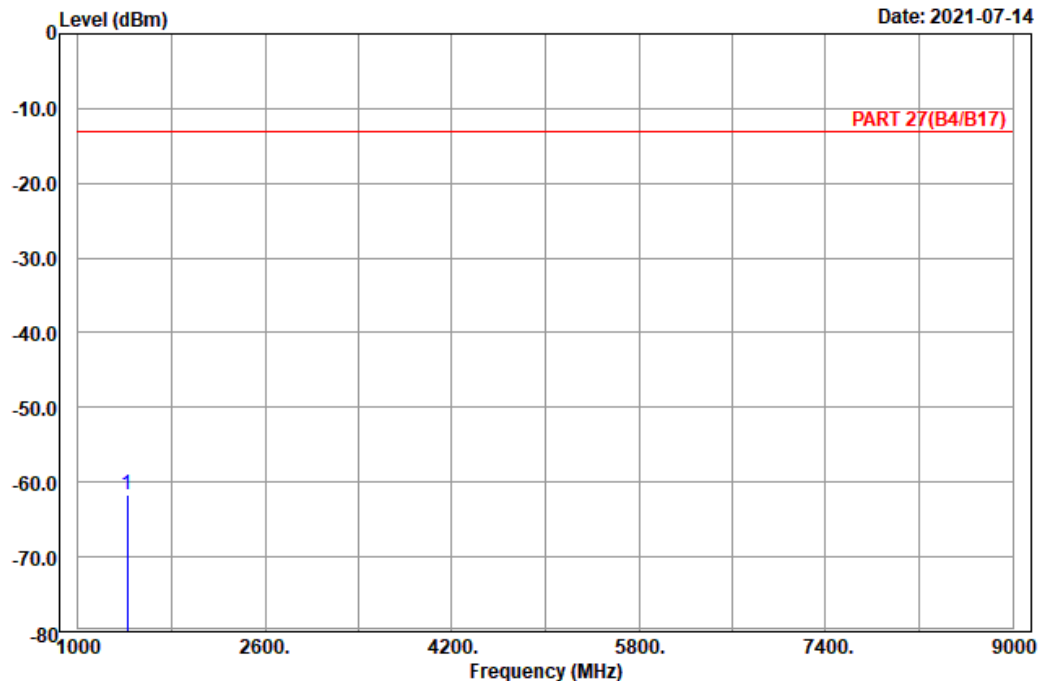


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 6

Date: 2021-07-14



Site : 966 chamber 1
 Condition: PART 27(B4/B17) Vertical
 Remark : LTE_Band 17_Link_L-Ch
 Tested by: Karl Lee

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBm	dBm	dB	dBm	dB	
1 pp	1418.00	-61.65	-68.01	6.36	-13.00	-48.65	Peak

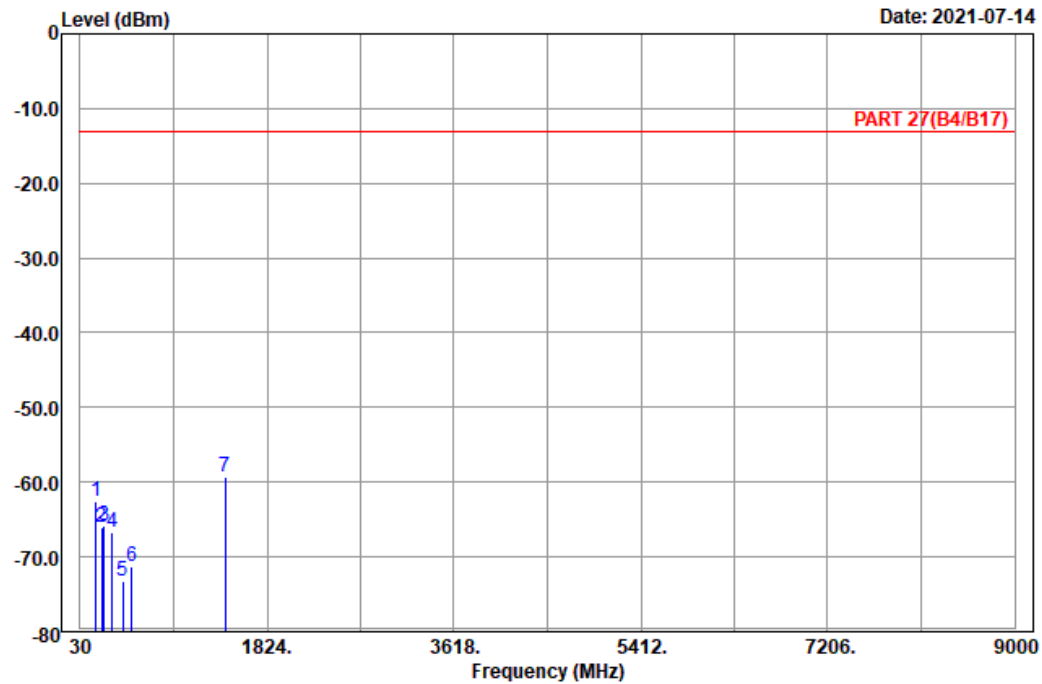
Middle Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 9



Site : 966 chamber 1
Condition: PART 27(B4/B17) Horizontal
Remark : LTE_Band 17_Link_M-Ch
Tested by: Karl Lee

		Read	Limit	Over	
Freq	Level	Level	Factor	Line	Limit Remark
MHz	dBm	dBm	dB	dBm	dB
1	181.74	-62.50	-56.91	-5.59	-13.00 -49.50 Peak
2	235.20	-66.02	-60.32	-5.70	-13.00 -53.02 Peak
3	259.50	-65.89	-60.29	-5.60	-13.00 -52.89 Peak
4	338.50	-66.60	-61.09	-5.51	-13.00 -53.60 Peak
5	440.00	-73.19	-69.56	-3.63	-13.00 -60.19 Peak
6	528.90	-71.21	-67.99	-3.22	-13.00 -58.21 Peak
7 pp	1420.00	-59.34	-65.70	6.36	-13.00 -46.34 Peak

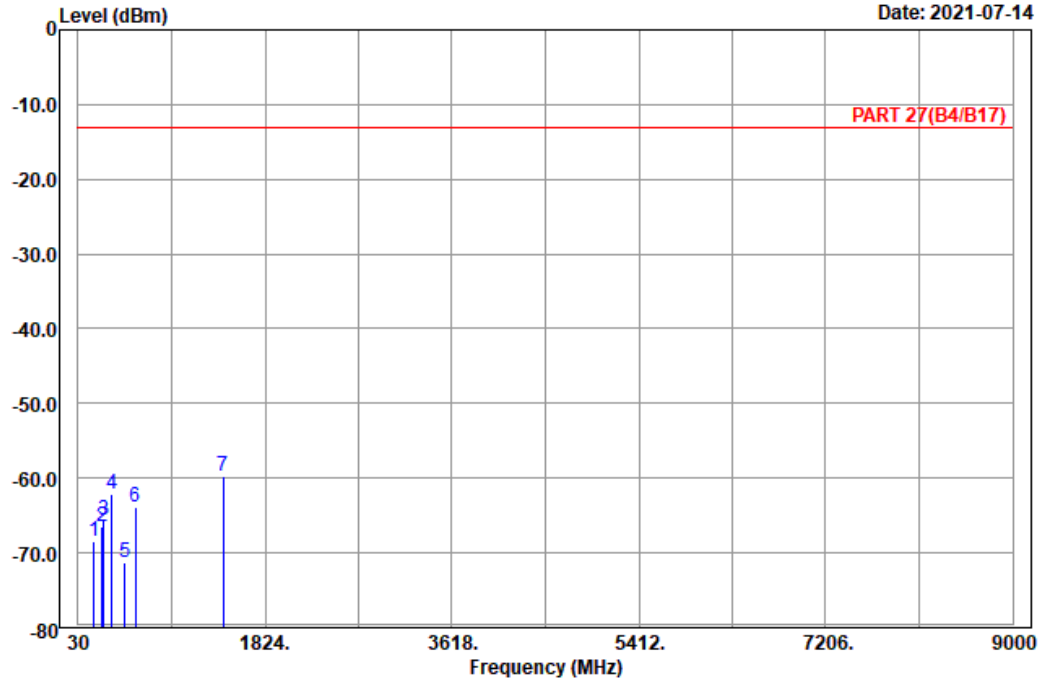


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 10

Date: 2021-07-14



Site : 966 chamber 1
Condition: PART 27(B4/B17) Vertical
Remark : LTE_Band 17_Link_M-Ch
Tested by: Karl Lee

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBm	dBm	dB	dBm	dB	
1	182.01	-68.55	-62.94	-5.61	-13.00	-55.55	Peak
2	261.66	-66.39	-60.78	-5.61	-13.00	-53.39	Peak
3	273.00	-65.52	-59.80	-5.72	-13.00	-52.52	Peak
4	351.80	-62.16	-56.89	-5.27	-13.00	-49.16	Peak
5	477.10	-71.29	-66.67	-4.62	-13.00	-58.29	Peak
6	577.90	-63.89	-63.39	-0.50	-13.00	-50.89	Peak
7 pp	1420.00	-59.68	-66.04	6.36	-13.00	-46.68	Peak

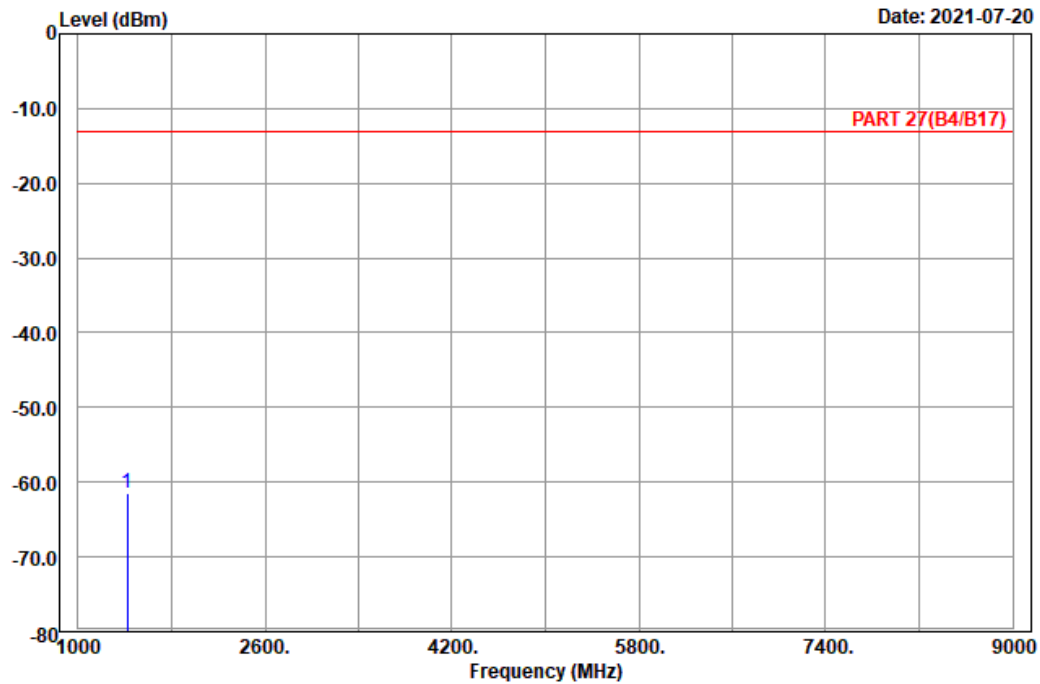
High Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 3



Site : 966 chamber 1
 Condition: PART 27(B4/B17) Horizontal
 Remark : LTE_Band 17_Link_H-Ch
 Tested by: Karl Lee

		Read	Limit	Over	
Freq	Level	Level	Factor	Line	Limit Remark
MHz	dBm	dBm	dB	dBm	dB
1 pp 1422.00	-61.57	-67.93	6.36	-13.00	-48.57 Peak

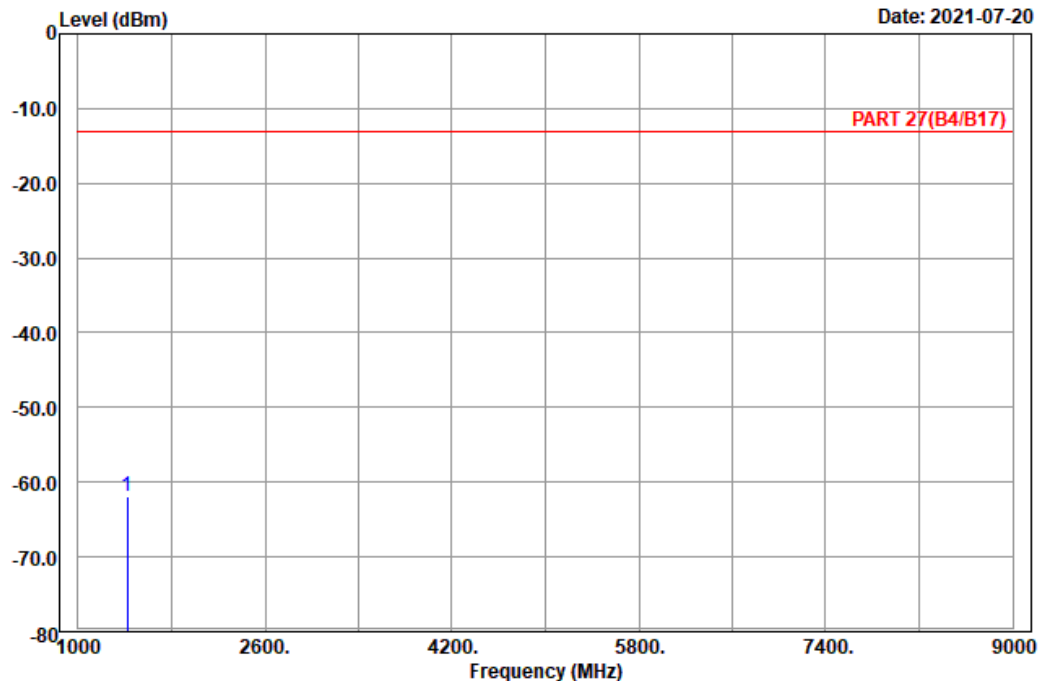


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 4

Date: 2021-07-20



Site : 966 chamber 1
Condition: PART 27(B4/B17) Vertical
Remark : LTE_Band 17_Link_H-Ch
Tested by: Karl Lee

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBm	dBm	dB	dBm	dB	
1 pp	1422.00	-61.90	-68.26	6.36	-13.00	-48.90	Peak

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

--- END ---